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Since the early 1980's an international debate has developed concerning the feasibility, necessity and ethics of whaling practices. There are two opposing perspectives in this debate. The "anti-whaling" perspective, often attributed to the US and UK, suggests that all whale populations should be fully protected from killing for commercial and research purposes. The "pro-whaling" prospective, often attributed to Japan, Norway and Iceland, suggests that some whale populations are abundant and can be killed for commercial and research purposes. This study explores the relationships between these dominant perspectives in published research on whales to investigate how these values may impact scientific research. 1991-2001 publication data from five marine biology research journals were analyzed for their frequency and likelihood to publish lethal and non-lethal sampling methods in whale research. A major finding is that pro-whaling countries published significantly more studies that employed dead specimens, while anti-whaling countries published more studies that employed living specimens. These results suggest that scientists' cultural values influence the scientific process.

Headings:

Ethics

Librarianship – International Aspects

Periodicals – Marine Sciences

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LETHAL SAMPLING METHODS AND WHALE RESEARCH: AN INVESTIGATION OF PUBLICATION DATA AND SCIENTIFIC VALUES

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Table of Contents

Abstract

Since the early 1980's an international debate has developed concerning the feasibility, necessity and ethics of whaling practices. There are two opposing perspectives in this debate. The "anti-whaling" perspective, often attributed to the US and UK, suggests that all whale populations should be fully protected from killing for commercial and research purposes. The "pro-whaling" prospective, often attributed to Japan, Norway and Iceland, suggests that some whale populations are abundant and can be killed for commercial and research purposes. This study explores the relationships between these dominant perspectives in published research on whales to investigate how these values may impact scientific research. 1991-2001 publication data from five marine biology research journals were analyzed for their frequency and likelihood to publish lethal and non-lethal sampling methods in whale research. A major finding is that pro-whaling countries published significantly more studies that employed dead specimens, while anti-whaling countries published more studies that employed living specimens. These results suggest that scientists' cultural values influence the scientific process.

Introduction

Since the early 1980s, a heated international argument has developed surrounding the feasibility, necessity, and ethics of whaling practices. Two opposing wildlife management approaches lie at the heart of these debates. “Anti-whaling” views, often attributed to the United States and United Kingdom, suggest that all whale populations should be fully protected from exploitation until all populations are accurately counted, thoroughly described and understood. “Pro-whaling” views, frequently voiced by Japan, Norway, and Iceland, contest that some whale populations have been accurately counted. These scientists argue that whales cannot be thoroughly described without lethal sampling research. Futhermore, whaling advocates suggest that whenever whale populations are found to be abundant, the animals can and should be exploited for scientific research and commercial purposes. These conflicting approaches to whale population management reflect some of the cultural values and political beliefs of their advocates. So, when whaling issues are debated internationally, values and beliefs collide and emotions often escalate (Friedheim, 1996; IWC, 2000; Stoett, 1997).

Both “anti-whaling” and “pro-whaling” countries quarrel over the merits and feasibility of whaling from political, cultural, and scientific standpoints. As one might guess, arguments based on political beliefs (‘whales entering our national waters belong to our nation’) or cultural values (‘commercial whaling is part of our national heritage’) can quickly become emotionally charged and may end unproductively (Friedheim, 1996; IWC, 2000). Scientific thought, on the other hand, is traditionally characterized as being detached from value judgments and emotion.

Whaling disputes based on scientific evidence, then, should be similarly neutral. However, in the last thirty years social scientists have begun to suggest that scientific thought is sometimes

heavily influenced by the values or beliefs of an individual and/or group. This paper examines the possibility of bias among one group of scientists – the International Whaling Commission Scientific Committee – as evidenced by their publishing trends, over the last decade, of whale research involving lethal sampling methods.

The International Whaling Commission (IWC) is an international policy-making group whose decisions are guided by the empirical research findings of their own Scientific Committee. The IWC itself was originally formed in 1946 as a regulating body for the commercial whaling industry (IWC, 2000; Komatsu, 1974; Mann, 2000; Stoett, 1997). The Commission's main purpose was to monitor and help conserve whale populations for the whaling industry, ensuring that individual countries did not exhaust the world's supply of whales. In spite of the IWC's efforts, however, whale populations were over-harvested and species were declining rapidly by the early 1970s (IWC, 2000; Stoett, 1997). In 1976, the IWC imposed stringent catch quotas on all commercial whaling operations in response to data showing dwindling whale (cetacean) populations. Shortly thereafter, the commercial whaling industry became economically unfeasible and effectively came to an end.

The whaling industry's decline was due in part to the whaling quotas, and also to a new "environmental ethic" that many industrialized countries were beginning to develop. This new ethic found the practice of commercial whaling to be unacceptable and was often characterized by a preservationist ideal (Mann, 2000; Stoett, 1997). This ideal supports preserving nature completely, as opposed to the previously held utilitarian ethic which viewed the environment as an inexhaustible resource for humans to consume. In addition to commercial whaling, "aboriginal subsistence" whaling practices of many fishing cultures such as the Alaskan Makah, were also becoming ethical questions for many countries by the end of the 1970s.

With no whaling industry to regulate in the late 1970s, the role of the IWC obviously began to change. The Commission began to focus its efforts on the immediate conservation of

whales for the sake of the environment. IWC members from pro-whaling countries argue that, once whale populations are stable, the IWC should revert back to its role of supporting a responsible commercial whaling industry. However, Commission members from anti-whaling countries seem more comfortable with the IWC's new role as the world's whale preservationist organization (Nagasaki, 1990; Stoett, 1997). The future role of the IWC is a critical issue to Scientific Committee members, since this defined role will help the Committee define and prioritize current and future research efforts. Also, as mentioned earlier, all international whaling policy decisions are guided by the empirical research findings of the Scientific Committee.

As a research group, the IWC Scientific Committee has a unique and powerful role as compared to many other scientific groups. Traditionally, scientists present recommendations to policymakers which are then weighed with other political and economic considerations. The IWC Scientific Committee, however, presents empirical research findings to the IWC that are meant to solely determine all international policy regarding whale conservation and management. While their findings and recommendations must be interpreted by non-scientific IWC members before policies are established, the Committee's counsel still theoretically determines policy. Therefore, the composition of the Scientific Committee and the participating scientists' interests become politically essential to IWC member countries.

The Committee is comprised of more than 120 scientists representing the 42 participating IWC countries from both pro-whaling and anti-whaling camps, and all policy recommendations must pass by a two-thirds vote (see Appendix 1). Some Committee scientists are appointed by their home governments, while others are invited by current Committee members (IWC, 2000).

Committee members have debated for more than two decades the issue of commercial whaling and its consequences (Friedheim, 1996; IWC, 2000; Komatsu, 1974; Mann, 2000; Nagasaki, 1990; Stoett, 1997). More recently, the group has also begun debating the necessity and consequences of lethally sampling whale populations for scientific research (Mann, 2000;

Nagasaki, 1990; Stoett, 1997). Committee members argue - often heatedly - over interpretations of current whale population empirical data and the validity of that data (Friedheim, 1996; IWC, 2000; Komatsu, 1974; Mann, 2000; Nagasaki, 1990; Stoett, 1997). Debates have also recently developed over the sampling methods that some studies employ, and the relative importance of those studies to current whale conservation efforts (IWC, 2000; Nagasaki, 1990).

Whales can be studied using lethal or non-lethal sampling methods, and each method potentially yields some information which the other method cannot provide (IWC, 2000; Nagasaki, 1990; Ohsumi, 1995). Over the last two decades, the Committee has begun to monitor and restrict lethal research conducted on the world's whale populations. In 1982, in an effort to unify the direction of IWC conservation efforts, the Committee required that any further scientific studies involving the lethal sampling of cetaceans must first be reviewed and approved by the Scientific Committee (IWC, 2000; Stoett, 1997). Also beginning in 1982, the IWC employed an anonymous peer-review process for all submissions to their publication *The* Journal of Cetacean Research and Management. The IWC has reportedly developed and imposed other increasingly stringent scientific research guidelines since the 1980s as well, the most recent set being implemented in 1999. These additionally restrictive guidelines include evaluations such as "whether the methodology and sample size are likely to provide reliable answers to the questions being asked," "whether the questions can be answered using non-lethal research methods," and "whether there is the potential for scientists from other nations to join the research programme" (IWC, 2000).

In 1986, in further response to apparently dwindling cetacean populations, the IWC issued a worldwide moratorium on the hunting of any whale species. Norway is the only IWC member that currently continues to whale for solely commercial purposes, refuting this moratorium. Norwegian whaling operations are limited to their national waters, a right that was provided for all IWC member countries in the 1946 International Convention for the Regulation

of Whaling. Japan presently continues to capture and kill whales for scientific research purposes, afterward selling the carcasses commercially in Japan as also required by the 1946 Convention. The persistence of Japan to continue lethally sampling whale populations for research has agggravated many members of the IWC and Scientific Committee (IWC, 2000).

The IWC and others acknowledge a sharp division among IWC members, labeling members as being from either 'pro-whaling' or 'anti-whaling' countries (Friedheim, 1996; IWC, 2000; Mann, 2000; Nagasaki, 1990; Stoett, 1997). The most vocal opponents of commercial whaling within the IWC are the United States and United Kingdom, while Norway and Japan are the most vocal supporters (IWC, 2000; Stoett, 1997).

As already mentioned, the Scientific Committee's interpretation of empirical research data, such as whale population data, has a direct effect on international whaling policy. At the same time, these international policies help currently determine – via the IWC Scientific Committee – what types of research can be conducted on the world's whale population. Since the 1970s, scientists from 'pro-whaling' countries have argued that their submitted research is being overlooked or misinterpreted because the methods or findings they present conflict with the values of 'anti-whaling' Committee members (IWC, 2000; Kumatsu, 1974; Mann, 2000; Nagasaki, 1990; Stoett, 1997). In this paper, possible publication trends of lethal whale resarch by "pro-whaling," "anti-whaling," and international or "neutral" professional journals will be examined, contrasted, and compared to the IWC Scientific Committee's publication history over the past decade.

Relevant Literature

Exploring the above issues required working with literature from several disciplines - sociology, social psychology, decision theory, public and international policy - and understanding a few theoretical frameworks and basic definitions. To begin this research, a working definition of "science" itself was necessary.

When referring to science throughout this paper, the dominant definition of science in society today was intended. That is, science as it is currently practiced by most of the industrialized world. Sociologist Robert K. Merton described four "universal" norms of science in his work *The Sociology of Science* (Merton, 1973). Merton is recognized as a pioneer in the social sciences, and Sociology of Science is a compilation of his best-known, often cited works. His four norms of science - Universalism, Communism, Disinterestedness, and Organized Skepticism - have become generally accepted across disciplines.

The norm of Universalism referred to the idea that truth claims are judged by impersonal criteria. Communism stated that all scientific discoveries should be shared or made common knowledge. Disinterestedness referred to the idea of pursuing science for the goal of furthering science, rather than for furthering one's self. The norm of Organized Skepticism stated that scientists' work detached from their personal beliefs. Merton observed that science was an institution, and comprised a culture unto itself.

In a 1957 paper entitled "Priorities in Scientific Discovery," Merton noted that the institute of science had developed an "elaborate system for allocating rewards to those who variously live up to its norms."(p.297) This observation was echoed in 1962 by another social scientist, Thomas S. Kuhn (1996), in his work *The Structure of Scientific Revolutions*. Kuhn perceived a number of serious problems with the culture of science and he cited the elaborate reward system as one.

Kuhn proposed that science, as it was currently practiced, frequently (in some cases *always*) violated the very norms Merton had outlined. Kuhn depicted scientists hurriedly completing their work in order to personally reap the rewards of the system – eponymy, publicity, prizes, and further funding. Kuhn described the development of scientific paradigms as a wide acceptance of theories which usually only held true in specific situations, under specific conditions. Kuhn also noted that theories were often adopted by scientists for aesthetic reasons – because the new theory just felt "'neater,' 'more suitable' or 'simpler' than the old." (p. 154).

According to Kuhn, once a theory had reached the status of paradigm, it would never be rejected unless a replacement theory was available to take its place. And in practice, Kuhn said, paradigm theories were rarely challenged whatsoever. Challenges that did arise were usually either met with extreme criticism from the scientific community and rejected, or were simply not acknowledged. Furthermore, their peers usually socially rejected scientists challenging an established paradigm theory. Such practices and qualities would certainly fall well outside of Merton's concepts of detached, impersonal scientific skepticism.

Over the last several decades, numerous authors have examined or questioned the impartiality of science, and the values that actually guide and define the scientific culture (Hammond, 1992; Koehler, 1995; MacCoun, 1998). Merton depicted science as a value-free endeavor, which required scientists to be neutral in their pursuits. Numerous authors in the social sciences literature have since made note that the idea of neutrality ("value-free" reasoning) is a value itself – and a decidedly European value. Is the culture of science then defined by European cultural values and beliefs?

Definitions of culture are plentiful in the social sciences literature, and no single definition appears to have been widely adopted and applied in the field. However, most of the definitions reviewed during this research commonly separated the term culture into at least three

parts: values, attitudes, and behaviors. While reviewing literature for this paper, three cultural frameworks were discovered that each seemed applicable.

Nancy J. Adler, in her work *International Dimensions of Organizational Behavior* (Adler, 1991), applied the following definitions: Culture is a collection of values, beliefs, artifacts and behaviors which are shared (and eventually passed on) by groups of people. Culture is basically the cumulative result or outcome of any group of people sharing six basic orientations. Specifically, people of a particular culture will all share: fundamental beliefs about the *nature of individuals* (e.g. people are basically bad); a basic *world view* or an understanding of how individuals relate to the natural environment; beliefs about how *individuals relate to other people*; a common *activity mode* (are they, for example, a highly goal-driven group?); conception of *space*; orientation of *time*.

Adler believed that culture generally defines a group's set of values, which define attitudes, which define behaviors. And, cyclically, she believed a group's behaviors would eventually influence and help define the culture. For Adler, values could be both conscious and unconscious. Throughout a lifetime, values would ultimately guide an individual's choices from whatever "modes," "means" and "ends of action" were made available. Attitudes expressed values and disposed a person to act or react toward something in a certain way. Behavior was simply any type of human action.

Adler's cultural framework lent itself to this research topic in terms of trying to understand the cultural backgrounds of IWC scientists. The research presented here also concerned biodiversity issues. Therefore, a second framework which placed greater detail on cultural orientations to the natural world was needed. Adler's depiction of culture's influence on behavior relied on a more linear model than other authors presented. The interactions and influences of values, attitudes and behaviors associated with the development of international policy would be further described using broader frameworks.

In *Culture and Environment*, Irwin Altman (1980) provided a social-systems framework for exploring the relationships between human culture and the physical environment. Adler identified and categorized basic elements of culture in a very clear and logical way. Altman's framework weighed and ordered elements nearly identical to Adler's; he expanded on her "orientation to the natural environment" elements, then placed all of those orientations within a context more applicable to this study.

Altman chose a social-systems approach because he believed that culture and environment are a network of related factors which can have an impact on each other. The elements that comprised his framework were a culture's: *natural environment* (e.g. mountainous, desert); *world view* and orientation toward the environment; *environmental behaviors* (e.g. crowding, sprawling cities); *environmental cognitions*; and *environmental outcomes*.

Altman proposed that every variable within his framework could theoretically serve either as a cause or an effect. For example, a culture's behaviors could cause erosion of their natural environment; likewise, an eroded natural environment could elicit specific behaviors from a culture. It seemed possible that a similar two-way relationship could exist within the topic of this study: that cultural values and beliefs of IWC Scientific Committee members may influence their individual or collective interpretations of empirical scientific research and that such biased interpretations of research could, in turn, affect (affirm, strengthen or weaken) cultural values and beliefs.

A number of bias studies were conducted and published over the last several decades. Many of these studies focused decisions and outcomes in legal situations, such as bias among jurors. The literatures of Decision Theory and Social Psychology also contributed a large number of empirical and theoretical studies. A small number of studies particularly focusing on the study of bias among scientists were discovered, as well. While no research identical to this paper was

located during reviews of the literature, several useful studies containing comparable aspects of this study were found within the above-mentioned disciplines.

Kerr, MacCoun & Kramer (1996) compared bias in judgment among individuals and groups. The study was purely theoretical, and pointed to other recent empirical findings which supported their claims. Equally important for this paper's purposes, Kerr laid out very concise definitions of terminology and concepts crucial in bias study.

Kerr first outlined three basic types of bias and methods for studying them. Judgmental Sins of Imprecision (JofI) were an essentially theoretical form of bias rarely seen, but often useful when measure for the following types. JofI were analyzed by direct comparison between judges and the criterion used. In other words, if judges were asked to add 2 + 2, a judge offering an answer other than four would probably be exhibiting some sort of bias. The problem with this measure was that it assumed a "correct" answer exists and was known.

Next, Kerr outlined Judgmental Sins of Commission (JofC) which had some direct application to this study. JofC said that some information is irrelevant or non-diagnostic for making judgments. Such irrelevant information is not used in an unbiased decision. For example, the race of a defendant would be considered irrelevant for a jury's decision. Jurors who allowed that information to affect their judgments would have been exhibiting a JofC bias. To study this bias type, Kerr suggested an experimental group and a control group. The experimental group would be presented with the irrelevant information, and the control group would not. Decisions of the two groups would then be compared.

Finally, Kerr discussed Judgmental Sins of Omission (JofO) In JofO scenarios, decision makers either ignored information which was crucial to their judgment or the information was somehow processed incorrectly. Kerr suggested that, in the latter cases, the information would be processed in a way which supported the decision maker's prior beliefs. To study JofO cases, groups would be given different base rate information, then their judgments would be compared.

As already mentioned, Kerr cited two empirical studies by other researchers for each of the theories he presented. In each case, the studies confirmed Kerr's theories. Such group-decision studies were of particular relevance to this study examining the outcomes of the IWC Scientific Committee's discussions.

Lord, Ross & Lepper (1979) studied decision making among individuals rather than groups, and focused on the effects that prior beliefs might bring to decision making situations. Lord proposed a Polarization Hypothesis which suggested, basically, that decision makers would accept at face value most evidence which "confirmed" their prior beliefs, theories or expectations. Any evidence which did not support their prior beliefs was scrutinized and often perceived as unclear, inconclusive, or somehow otherwise flawed. In the presence of inconclusive evidence, Lord showed that the decision maker's prior beliefs and theories became even more firmly held.

Lord's study involved college students who were paid for their participation. He required them to make policy decisions regarding capital punishment, given hypothetical "scientific" evidence. Participants' beliefs were all identified prior to beginning the studies, then very basic and unclear evidence was presented and read. Preliminary judgments were registered by the participants. Next, they received booklets containing hypothetical empirical studies. The information was read, and judgments on the evidence were registered followed by judgments on the capital punishment issue at stake. The end results of Lord's study cleanly supported his theory of Polarization. Students had interpreted the basic, inconclusive evidence as well as the empirical evidence in support of their prior beliefs.

Jonathan Koehler (1995) studied the influence of prior beliefs on groups of people, and specifically on scientific judgments. Koehler's study was closely related to the topic of this paper. His work here was similar to Lord's but used scientists as the subjects. Koehler presented two studies to test for possible bias effects.

The first study was comprised of two groups of science program graduate students. The second study involved sending questionnaires to some 200 practicing psychologists and parapsychologists, all known to be outspoken either for or against the validity of ESP research. The study played out very similar to Lord's research, with the exception that participants received one of four "scientific studies" which differed in empirical strength.

In the end, Koehler discovered that even these scientists would accept poorly formed or inconclusive studies as "good," if the study supported their prior beliefs. Likewise, empirically strong studies supporting an unwanted view were generally rejected as being inconclusive. Many scientists and observers of international politics have criticized the IWC Scientific Committee for operating precisely in this biased manner.

The issue of whale conservation has been a heated topic of debate for decades. The highly emotional reactions elicited by the topic itself – from scientist, politician and layperson alike - suggest that whale conservation issues might influence and be influenced by individual cultural values, attitudes or beliefs pertaining to ethics and the natural environment.

Dunlap & Van Liere (1970) devised a method for measuring an individual's degree of belief or acceptance of proposed environmental values. At the time that study was written, many social scientists believed the United States was adopting, as a society, more environmentally sound beliefs and ethics. Dunlap set out to measure the acceptance of what he considered to be the "New Environmental Paradigm" by use of questionnaires. His study supported his hypothesis that such a paradigm existed and was becoming dominant in our society.

The Dunlap study presented some difficulties, however. The development of the questions which comprised the instrument were never discussed. The author assured readers that the questions were created thoughtfully, and that they captured the intended information. These claims were unsupported by any written documentation. Additionally, the "new" paradigm Dunlap discussed was not being compared to the alleged "old" paradigm. Regardless, the

instrument design and the methods for trying to obtain environmental values were extremely useful to the research presented in this paper.

Gregory, Lichtenstein & Slovic (1993) proposed that environmental values be assessed by employing a common economics tool. A Contingent Valuation (CV) is a practice used primarily on "public goods" to estimate the economic value of environmental improvements and damages. CVs ask the participant to assign monetary values to items – in Gregory's case, to environmental qualities such as clean air or water. That figure would be the amount the participant would be willing to pay in order to maintain or achieve a particular quality or object.

Gregory found, as she read other studies and discussed CV results with participants, that individuals completing a CV often felt their valuations did not match the true value they place on certain environmental qualities. Participants were more satisfied with their stated valuations when they were asked to rate *pairs* of objects, qualities. For example, placing a dollar value on a new energy efficient car *and* a new landfill technology.

Gregory believed that individuals largely were not able to complete CVs accurately, because people tend to value environmental qualities separate from other (economic) values. She argued that CVs are a valuable tool – not for understanding an individual's environmental values, but for helping people to actually create a value structure which incorporates both economic and environmental goods or qualities.

Hammond, Harvey & Hastie (1992) further discussed the difficulties of mentally separating issues. Hammond observed that scientists often had difficulty making scientific decisions because those decisions of fact become confused with the inevitable policy decisions they would fuel. The article was theoretical, and suggested that some common empirical methods used in psychology could be easily applied to science/public policy dilemmas.

Hammond suggested Signal Detection Theory and the LENs Model of Social Judgment Analysis as two ways of separating science and policy into fact and decision criterion (action). He

proposed a Separatist Ideal, stating basically that decisions of fact and value judgments could be empirically disentangled. Like Hammond, many of the other works cited in this paper proposed empirical analysis methods.

Bayesian statistical research methods were employed by nearly all of the studies reviewed. Bayesian Theory (Bernardo, 1994) essentially stated that every decision problem would have a set of available actions. Each set of actions would yield a set of uncertain events, describing the uncertain outcomes of taking a particular action. So, each set of uncertain action would have a corresponding set of consequences.

Bayesian theorists examine actions and outcomes within the context of the certainty/uncertainty of individual decision problems. The theory attempts to isolate, remove, or in some way quantify or give a value to uncertainty. Once this value has been determined, simulations can be run and predictions made. Trying to determine and describe the context of each decision problem facing the IWC Scientific Committee seems like a sizeable task. For instance, the level of uncertainty involved in the individual responses of 120 scientists to a single issue would be high. Add possibly 40 different cultural responses to the same issue, and the potential personal and cultural responses to the other scientists' responses, and the uncertainty values for the issue must be substantial. In the research proposed here, possible publication trends are examined. A more intensive study of this issue would produce much more data, and would probably apply the more rigorous Bayesian analyses.

Likewise, *cetacean research* refers to a very broad area of study which was immensely simplified for the purposes of this paper. Very simply, all cetacean research employs one of two sampling methods: lethal or non-lethal. Lethal sampling studies require that the whale be killed or discovered dead in order to carry out the intended research, while non-lethal studies leave the animal alive.

Each sampling method can yield unique information which the other method cannot provide (IWC, 2000; Nagasaki, 1990; Ohsumi, 1995). For example, determining a cetacean's sexual maturity or age requires that the sample be dead, since methods for obtaining that information require dissection. Similarly, group behavior research requires the observation of living animals.

As mentioned earlier in this paper, some cultures represented within the IWC have developed anti-whaling values, beliefs or views since the 1940s. The lethal sampling of whales may well be viewed by many of these cultures as an extended form of whaling and an equally unethical practice, regardless of the scientific data produced by such methods.

Since the early 1980s, many members of the IWC and it's Scientific Committee have routinely accused Japanese cetacean research programs of being merely guises for the continuance of commercial whaling during the IWC moratorium (Friedheim, 1996; IWC, 2000; Mann, 2000; Stoett, 1997). Anti-whaling members point to the fact that whale meat resulting from Japanese research is then sold commercially on the Asian market. Japan responds that the IWC Charter actually requires such sale following research, whenever possible (IWC, 2000).

Since the whaling moratorium was proposed in 1976, Nordic and Japanese researchers have contended that some whale stocks were large enough to support continued hunting. Japan and others continue to point to population data for particular species of whale – primarily the minke, brydes and sei – and interpret the data to mean abundance. Many Committee members question the validity of that data, and/or the pro-whaling countries' scientific interpretation.

Research Methodology

To examine possible biased decision making by the IWC Scientific Committee, I studied the group's publication decisions for evidence of possible Judgmental Sins of Commission. I compared the research publication trends of the Committee over the last decade with the trends of five other comparable, established national and international research journals during that same time period.

When comparing journal data, possible trends were sought in the publication of research articles that involved lethal sampling methods. As mentioned earlier, Judgmental Sins of Commission occur when decision makers allow irrelevant information to influence their judgments. In the context of the international IWC Scientific Committee, cultural values and views regarding whaling and related conservation and preservation ideals could constitute such irrelevant and potentially biasing information. This correlation, however, is only speculative. Attempts at identifying possible biasing influences for the Committee, or to correlate the Committee's publishing trends with those possible influences are well beyond the scope of this research. The publishing trends sought in this paper may only signal a need for more intensive analyses of the issues outlined.

This study assumed that the publishing of research within a well-established journal signifies acceptance of that research by the dominant scientific culture. In other words, such publication implies that the research is considered valid and within the norms of "good" science by the dominant science community. The journals selected for analysis provided a cross-section of governmental and private publications from both pro- and anti-whaling countries, as described below.

Journals Analyzed

Journal of Cetacean Research and Management (ISSN: 15610713); previous title Report of the International Whaling Commission (1977-1998, ISSN: 01438700): This is the official research publication of the International Whaling Commission, whose publication trends were compared and contrasted with the following titles.

ICES Journal of Marine Science (ISSN: 10543139) is an international journal for marine biology published in Copenhagen from 1881-1990, continued in the UK from 1991-present. The journal's editorial board represents whaling and non-whaling countries alike.

Fisheries Science (ISSN: 09199268) is a Japanese journal published in English, bimonthly, by a publishing house in Australia. The journal's Editor in Chief and editorial board members are all from Japan, a country currently engaged in whaling for scientific purposes. The resulting whale carcasses from such research are then often sold on the Japanese market, as provided by the International Convention on Whaling.

Nippon Suissan Gakkaishi (ISSN: 00215392). Fisheries Science is supplemented during alternate months by Nippon Suissan Gakkaishi, which is written in Japanese, has a Japanese editorial board, and is published in Japan.

Canadian Journal of Fisheries and Aquatic Sciences (ISSN: 0706652X) is a Canadian scholarly journal which frequently publishes original cetacean research. Canada ceased all commercial whaling operations in 1973. The country was - and continues to be - very supportive of aboriginal subsistence whaling. Canada left the IWC in 1982, believing that the rights of aboriginal whaling communities would not be protected by IWC policies. Since that time, Canada has rejected IWC population management standards in favor of their own standards for aboriginal whaling. The journal's editorial board members are primarily Canadian, though the UK and US are both represented as well.

Proceedings of the Royal Society of London, Series B: Biological Sciences (ISSN: 00804649) is one of the oldest journals in the biological sciences. According to marine biologists contacted during this study, the journal is also highly respected. This journal has a very broad scope, and publishes only a few cetacean research articles each year. The editorial board members are currently all from the UK.

Several criteria were used in selecting these titles. First, a list of often-cited and well respected journals in the field was created by reviewing the marine biological sciences literature and citation indexes, comparing ISI Impact Factors and circulation sizes among titles, and soliciting journal recommendations from biologists currently involved in cetacean research. Impact Factors were not available for the Journal of Cetacean Research and Management or it's preceding title, Reports of the International Whaling Commission. The impact factors for this title were calculated by dividing the number of cites to the source over the previous two years studied by the total number of articles published by the journal during that same period. Next, because publication data over the past decade was needed, any titles which had begun publication within the last decade were removed from the list. Because all relevant articles published over the last decade were to be retrieved, any journal which was not indexed through 1991 (either electronically or in print) was next removed from the pool. Due to time and financial constraints, the list was further reduced to only titles which were available from nearby universities or colleges – "nearby" meaning within a two-hour drive from UNC Chapel Hill.

Finally, based on literature related to current international whaling issues, and also based on the responses and recommendations solicited from marine mammal biologists, a group of journals was selected which represented multiple political viewpoints commonly found in the international debates over whaling. Specifically, the IWC Scientific Committee is represented, two of the most vocal IWC member countries on both sides of the whaling issue are represented

(Japan and U.S.), a fairly apolitical, international voice is represented (ICES), and a pro-aboriginal whaling nation that does not participate in the IWC is represented (Canada).

The circulation size of each title used in this study was also compared to the circulation sizes of all other journals from that same country. For example, 15.51% of all UK journals have a circulation size of 1000-5400. The other country-specific searches each showed that 12-22% of the countries' titles have a comparable circulation size. While these comparisons did not address circulation size by journal discipline, the percentages used were assumed to be significant (see Appendix II).

A limitation of this study is that the selected titles differed in scope and publication frequency. Some of the journals published on a monthly basis, while others published only once a year (see Table 1). Some titles were focused purely on cetacean research, while others published research related to many aspects of marine biology. As a result, sample sizes by title varied greatly. These differences in scope and publication frequency posed real limitations to this study. In a larger study, these differences would be best addressed through statistical and sampling methods. In a more in-depth examination, an Analysis of Variance test would compensate for these publication frequency discrepancies. The IWC's Journal of Cetacean Research and Management has a current circulation size of roughly 200. The other five journal titles selected for this study had circulation sizes between 1000-5400. Ulrich's International Periodicals Directory shows that 57.47% of all the 119,140 titles listed for 2001 have a circulation between 1-5400. Additionally, more than 36% of all journals currently listed in Ulrich's have a circulation between 1000-5400.

Table 1. Descriptions of Journals Reviewed

Abbrev. Title	JCRM Journal of Cetacean Research and Management (RIWC Reports of the International Whaling Commission)	ICES Journal of Marine Science	CJFS Canadian Journal of Fisheries and Aquatic Sciences	PRSLB Proceedings of the Royal Society of London, Series B: Biological Sciences	FS Fisheries Science	NSG Nippon Suissan Gakkai Shi
Country	UK	DK	CA	UK	JP	JP
Start Date	1949	1881	1938	1905	1947	1932
Circ. Size	200	1,000	3,000	1,112	5,400	5,200
Frequency	3 per year	Bimonthly	Monthly	Semi-monthly	Bimonthly	Bimonthly
Impact Factors	0.838 (1990) 1.391 (1998)	0.714 (1990) 1.080 (1998)	1.502(1990) 1.737(1998)	2.588(1990) 3.033(1998)	0.570(1990) 0.951(1998)	0.330 (1990) 0.571 (1998)
Source	CSA	BIOSIS	CSA	Biosis	CSA	CSA

KEY for Table 1

Abbrev. ……... Abbreviated journal title
Title……..… Journal Title including abbreviation
Country……... Country in which the journal is published
Start Date……. Date that the journal began publication
Circ. Size…….. Size of the journal's circulation
Frequency…… How often the journal is published each year
Impact Factors…… ISI Impact Factors
Source…….. Name of the index used in this study

Data Collection

Full citations and abstracts were available electronically for all journals used in this study. Data was retrieved from each journal using the following search strategy:

S1 Search Journal title, all years

S2 Search for terms (whal$ or cetacea$.) in the Title, Abstract, Descriptors, and body text of all articles in database

S3 Combine (set 1) and (set 2)

S4 Limit results to publication years (1991-2001)

A citation database was created to hold all retrieved articles and associated journal information. Information kept from all retrieved citations was:

- Primary author's first initial, last name
- Primary author's country affiliation
- Other authors' first and last names
- Article title
- Journal title, volume, issue, date, page(s)
- Full text of article abstract

As each article record was entered into the citation database, each abstract was read. Based on the abstract, articles were then categorized as being one of three following types:

- research that employed lethal sampling methods
- opportunistic research that made use of a non-living specimen
- research which did not involve non-living specimens. Opinion pieces, literature reviews, and historical articles were also included in this category.

Examples of abstracts illustrating the three separate methodologies are provided below. Key words, phrases, and procedures which helped identify the methodology in each abstract have been highlighted in bold text. The majority of articles reviewed made their sampling method quite

clear in the abstract. Some articles, however, did require a very basic understanding of current whaling research and the associated methodologies on the researcher's part. For example, studies in which a whale's sexual maturity was determined or which required the retrieval and evaluation of stomach contents, ear plugs, or kidney tissue samples would have employed lethal methods in order to obtain the necessary data (IWC, 2000; Nagasaki, 1990; Ohsumi, 1995). In cases where the abstract did not make clear the sampling methodology, the article was flagged and later removed from the sample.

Examination of Abstracts

Studies employing lethal sampling methods

Example 1.

Haug, T, Gjosaeter, H; Lindstrom, U; Nilssen, K. (1995). Diet and food availability for North-East Atlantic minke whales (Balaenoptera acutorostrata), during the summer of 1992. ICES Journal of Marine Science, 52 (1), 77-86.

Stomach content samples from 92 minke whales, Balaenoptera acutorostrata, **caught during scientific whaling operations** in July-August 1992, were collected in five selected areas in Norwegian and adjacent waters. Results from the **stomach analyses** indicate a diet almost completely dominated by fish, although there was considerable heterogeneity in species composition between the areas. Capelin dominated the minke whale diets in the two northernmost study areas (Spitsbergen and Bear Island). Further south, in coastal areas of northern Norway and Russia, herring was the most important food item, but was accompanied by significant amounts of sand eel, cod, haddock, and saithe. A survey aimed to locate and classify fish and plankton resources was conducted simultaneously with the scientific whaling programme. The northern areas were dominated by 0-group cod (which was not found in whale stomachs), while capelin abundance was recorded only sporadically. Along the coast of northern Norway and Russia, there appeared to be a greater similarity between prey abundance and minke whale diet. Herring was very abundant both in the resource surveys and in the whale stomachs. The similarity in distribution was particularly evident for 0-group herring.

Example 2.

Kato, H, Zenitani, R. & Nakamura, T (1991). Inter-reader calibration in age readings of earplugs from southern minke whales, with some notes on age readability. Report of the International Whaling Commission, 41, 339-343.

The bias and magnitude of age reading differences from **growth layers in earplugs** from southern minke whales (Balaenoptera acutorostrata) are examined using the 356 paired readings used at the Minke Whale Ageing Workshop in 1983 and 187 paired readings from the **research permit catch in 1988/89**. Bartlett's three-group regression revealed no bias in the ageing between experienced readers with differences of about 1.2 layers (standard deviation). This magnitude can be used as the potential reading error for general analyses using southern minke whale age data. The inexperienced reader tended to count fewer layers than the experienced reader. An age readability index for minke whales in Japanese Antarctic catches increased with time, averaging 46% in 1971-77 and 73% in 1979-86, due to mainly decreasing handling damages. Readability also increased with body length up to 28 ft, at which it was around 65% in both sexes.

Studies making use of dead cetaceans

Example 1.

Patterson, I, Reid R, Wilson B, Grellier K, Ross H. & Thompson P. (1998). Evidence for infanticide in bottlenose dolphins: An explanation for violent interactions with harbour porpoises. Proceedings of the Royal Society of London, Series B: Biological Sciences, 265 (1402), 1167-1170.

Most **harbour porpoises found dead** on the north-east coast of Scotland show signs of attack by sympatric bottlenose dolphins, but the reason(s) for these violent interactions remain(s) unclear. **Post-mortem examinations of stranded bottlenose dolphins indicate** that five out of eight young calves from this same area were **also killed** by bottlenose dolphins. These data, together with direct observations of an aggressive interaction between an adult bottlenose dolphin and a dead bottlenose dolphin calf, provide strong evidence for infanticide in this population. The similarity in the size range of harbour porpoises and dolphin calves that showed signs of attack by bottlenose dolphins suggests that previously reported interspecific interactions could be related to this infanticidal behaviour. These findings appear to provide the first **evidence of infanticide in cetaceans** (whales, dolphins and porpoises). We suggest that infanticide must be considered as a factor shaping sociality in this and other species of cetaceans, and may have serious consequences for the viability of small populations.

Example 2.

Rogan, E. & Berrow S. (1996). A review of harbour porpoises, Phocoena phocoena, in Irish waters. Report of the International Whaling Commission, 46, 595-605.

This paper reviews and summaries published and unpublished information on harbour porpoises in Irish waters and presents results of recent research. Harbour porpoises have been recorded from all Irish coasts and have always been considered a coastal species. However, information from bycatch data suggests that it also regularly occurs offshore. **Stranded and bycaught animals were used** to examine reproduction, composition of prey species in the **stomach contents** and contamination of total and methyl mercury, organochlorines and radionuclides. Preliminary analysis shows that males reach sexual maturity at a length of between 1.3 and 1.4m. **All females examined were immature**. The most frequently recorded prey type was Trisopterus spp, followed by whiting Merlangius merlangus, poor cod T. minutus and herring Clupea harengus. Cephalopods recorded included Loligo forbesi and sepiolids. Prey remains from the stomachs of bycaught and stranded animals were similar, with fewer Clupidae and whiting recorded from the bycaught animals. **Bycaught animals** were not found to be feeding on the target species of the fishery they were caught in. Contamination levels of total and methyl mercury, 17 organochlorines and Cs-137 and K-40 were compared with porpoises from other geographical regions. Metal and organochlorine levels were generally lower than those recorded from other studies. Geographical differences in concentrations of Cs-137 were found, with samples from the Irish Sea having the highest concentrations. A review of published and unpublished records of incidental capture revealed 43 records of harbour porpoise bycatch in Irish waters. Most porpoises (98%) were caught in gillnets with 26 (63%) of these being caught in static gillnets and 12 (29%) in tangle nets. As part of an observer-based study of marine mammal bycatch in a gillnet fishery in the Celtic Sea, it was estimated that the total annual bycatch of harbour porpoises was between 1,825 and 2,049 (95% CI 657 - 3,361) for the combined Irish and UK fleets.

Studies making use of living samples

Example 1.

Holst, H. & Stirling, I. (1999). A note on sightings of bowhead whales in the North Water Polynya, northern Baffin Bay, May-June, 1998. Journal of Cetacean Research and Management, 1(2), 153-156.

As part of a multidisciplinary research cruise by icebreaker in the North Water Polynya in northern Baffin Bay, we conducted **shipboard surveys of marine mammal distribution and abundance** throughout the area from April to July 1998. Fourteen **sightings** of at least ten individual bowhead whales (Balaena mysticetus) were made during May and June. Five additional large baleen whales, whose identities were not confirmed, were **also seen**. As well as being an important feeding ground, the polynya may also serve as an overwintering site for bowhead whales of the Davis Strait/Baffin Bay stock.

Example 2.

Whitehead, H. (2000). Density-dependent habitat selection and the modeling of sperm whale (Physeter macrocephalus) exploitation. Canadian Journal of Fisheries and Aquatic Sciences, 57 (1), 223-230.

The **monitoring** and management **of sperm whale** (Physeter macrocephalus) **populations** have proved problematic. **Studies of living animals** indicate that movements are largely determined by resource availability, thus suggesting that density-dependent habitat selection may be a realistic framework within which to study sperm whale populations. **A model**, in which animals migrate between 2 x 2 degree squares at rates that depend on relative resource availability, **was used to examine the effects of whaling on measures of sperm whale abundance. The model simulated four types of whaling**: shore-based whaling, pelagic open-boat whaling by many boats, pelagic whaling by a fleet based around one factory ship, and pelagic whaling by a fleet sequentially exploiting different parts of the study area. Catch per unit effort was found to have little relationship with population size in any part of the study area for shore-based whaling and for pelagic whaling when the study area was sequentially exploited. Thus, in these circumstances, catch per unit effort should not be used as a measure of depletion. To give a reasonable assessment of depletion, **visual or acoustic surveys must extend well beyond the areas being exploited**.

Statistical Analysis

Descriptive statistics were generated for all data. In addition, elements from the coded publication data were placed into Crosstabs displays and were statistically analyzed using Pearson Chi-Square, Likelihood Ratio Chi-Square, and Fisher's Exact Tests. The elements used in analyses were author's country affiliation, journal title and country of publication, and the articles published by type. Some of the journal article sample sizes were too small to analyze statistically or significantly, which was a limitation of this study. However, statistical significance was calculated whenever possible.

Descriptive Statistics

Basic descriptive statistics were first generated to provide an overview of the publication data examined. Total numbers and percentages of articles published in each journal are provided in Table 2., as well as the numbers and percentages of individual article type (Lethal methods

employed, dead specimen samples, or living samples) by journal. Numbers and percentages of articles were also presented grouped by author's country affiliation and journal title.

In the last decade, Japanese and US authors published the most cetacean research articles in the journals examined for this study. Over 97% of all studies by US authors, and more than 78% of all Japanese-authored studies, were published in the Journal of Cetacean Research and Management. Additionally, more than 82% of UK-authored works appeared in the *JCRM*, as well as 81% of all Norweigian authored studies retrieved.

Table 2. An Overview of Article Types Published by Journal

Journal	Country of Pub.	Total Articles	Lethal Method Articles	% Lethal Method Articles	Dead Specimen Articles	% Dead Specimen Articles	% Lethal & Dead Articles	% Non-Lethal Articles
NSG	JP	6	1	16.67	2	33.33	50.00	50.00
PRSLB	UK	6	0	0.00	1	16.67	16.67	88.33
RIWC	UK	270	19	7.04	13	4.81	11.85	88.15
CJFS	CA	15	0	0.00	0	0.00	0.00	0.00
FS	AU	7	2	28.57	3	48.86	77.43	22.57
ICES	UK	12	1	8.33	1	8.33	16.66	83.34
JCRM	UK	36	0	0.00	3	8.33	8.33	91.67
TOTALS		**352**	**23**		**23**			

Note: Statistical significance was not calculated for values in Table 2 due to sample size.

Table 3. Article Types by Author Country Affiliation

Author Affil.	Total Art.	Total Lethal Art.	% Lethal Art	Total Dead Art.	% Dead Art.	Total Living Art.	% Living Art.	JCRM (RIWC)	FS	NSG	CJFS	ICES	PRSLB
US	81	0	0.00	9	11.11	72	88.89	79		1	1		
JP	61	15	24.59	8	16.39	38	59.02	48	7	6			
UK	41	0	0.00	2	4.88	39	95.12	34			1	3	3
NO	33	4	12.12	1	3.03	28	84.85	27			1	5	
CA	24					24	100.0	12			12		
ZA	23					23	100.0	22				1	
AU	17					17	100.0	16					1
BR	11	1	9.09	0	0.00	10	90.91	11					
AR	11					11	100.0	11					
ES	6	1	16.67	0	0.00	5	100.0	6					
DK	5					5	100.0	4				1	
DE	5					5	100.0	5					
IS	5	1	20.00	0	0.00	4	80.00	5					
MX	4					4	100.0	4					
SE	2					2	100.0	0					2
RF	3	1	33.33	1	33.33	1	33.33	3					
FR	3					3	100.0	2				1	
PE	2					2	100.0	2					
BC	2					2	100.0	2					
NL	2	0	0.00	1	50.00	1	50.00	2					
PH	1					1	100.0	1					
TH	1					1	100.0	1					
CL	1					1	100.0	1					
CN	1	0		1	100.0	0	00.00	1					
PR	1					1	100.0	1					
EC	1					1	100.0	1					
PT	1					1	100.0	1					
IT	1					1	100.0	1					
NZ	1					1	100.0	1					
NC	1					1	100.0	1					
CO	1					1	100.0	1					
Totals:	**352**	**23**		**23**		**306**		**306**	**7**	**6**	**15**	**12**	**6**

Note: Statistical significance was not calculated for percentages in Table 3

Statistics for Lethal Studies

Authors from 32 different countries were represented in this study. Of the 352 articles analyzed, authors from only six countries published research that involved lethal sampling methods: Japan, Norway, Brazil, Spain, Iceland, and Russia. Due to small sample sizes, possible relationships between an author's country affiliation and their likelihood to publish lethal-sampling research could not be calculated. Additionally, no significant statistics were calculated for possible relationships between individual journals and the publication of lethal-sampling research.

Statistics For Dead Speciman Studies

Likelihood Ratio Chi-Square and Fisher's Exact Tests did show significant correlations between some journal titles and the publication of studies using dead specimens. As an illustration from the Crosstab Table below, the journal Fishery Science (FS) published 3 articles using dead samples. Those three articles made up 13.0% of all dead sample articles in this study. Conversely, Fishery Science published 4 other articles which did not make use of dead samples. Those four articles accounted for only 1.2% of all articles in this study which did not use dead samples. In the following Table 4., "not dead sample articles" refers to any articles where either lethal sampling or living samples were used.

The numbers in Table 4. clearly indicate that the journal Fishery Science published a much larger percentage of dead sample articles than non-dead sample articles during the past decade. Similar relationships were also noted for the journals Canadian Journal of Fisheries and Aquatic Sciences (CJFS) and Nippon Suissan Gakkaishi (NSG). In contrast, the Journal of Cetacean Research and Management (JCRM) published significantly more articles employing not-dead samples. Again due to small sample sizes, any possible relationships between an

author's country affiliation and an author's likelihood to publish research using dead specimens could not be calculated.

Table 4. Dead Sample Articles and Journal Titles

		CJFS	FS	ICES	JCRM	NSG	PRSLB	Total
DEAD Samples	Count		3	1	16	2	1	23
	% within all DEAD		13.0%	4.3%	69.6%	8.7%	4.3%	100.0%
Not DEAD Samples	Count	15	4	11	290	4	5	329
	% within all DEAD	4.6%	1.2%	3.3%	88.1%	1.2%	1.5%	100.0%
Total	Count	15	7	12	306	6	6	352
	% within all DEAD	4.3%	2.0%	3.4%	86.9%	1.7%	1.7%	100.0%

Chi-Square Tests for Table 4.

Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	25.153	5	**.000**	---
Likelihood Ratio	14.888	5	**.011**	**.004**
Fisher's Exact Test	17.158		---	**.002**
N of Valid Cases	352			

Note: .000 significance indicates a probability of less than 1 in 1000 that the relationship occurs by chance.

Statistics For Living Specimen Studies

Significant relationships also appeared to exist between some journal titles and their publication of research utilizing living samples. These relationships resemble the inverse of those relationships described in the previous two tables. Journals which seemed to publish less in dead and lethal sampling studies above (see Table 4.), for example, appear to publish more in the living sample studies (see Table 5.).

Table 5. Living Sample Articles and Journal Titles

		CJFS	FS	ICES	JCRM	NSG	PRSLB	TOTAL
LIVING Samples	Count	15	2	10	271	3	5	306
	% within all LIVING	4.9%	.7%	3.3%	88.6%	1.0%	1.6%	100.0%
Not LIVING Samples	Count		5	2	35	3	1	46
	% within all LIVING		10.9%	4.3%	76.1%	6.5%	2.2%	100.0%
Total	Count	15	7	12	306	6	6	352
	% within all LIVING	4.3%	2.0%	3.4%	86.9%	1.7%	1.7%	100.0%

Chi-Square Tests for Table 5.

Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	31.366	5	**.000**	---
Likelihood Ratio	22.402	5	**.000**	**.000**
Fisher's Exact Test	22.122			**.000**
N of Valid Cases	352			

Discussion

The data gathered in this study presented several noteworthy points, and suggested areas of study that might benefit from further research. First, it was noted that the Journal of Cetacean Research and Management (JCRM) published articles from a wide range of authors, representing numerous countries over the last decade. More countries were represented in the pages of JCRM than in ICES Journal of Marine Science*s*, the "international" and "apolitical" journal selected for this study. This could suggest that Merton's norm of Communism is being upheld by the International Whaling Commission. Recording the number and types of articles submitted and

rejected by the IWC annually would help to further clarify the representation of country by author.

It was shown that the countries that have been some of the most vocal opponents, US and UK, and supporters of whaling over the last decade, Japan and Norway, also published the largest percentage of cetacean research articles during that time period. Furthermore, it appears that the vocal pro-whaling countries were the greatest publishers of lethally-sampled studies. This could suggest that the decision to sample whales lethally might somehow correlate with the scientist's political or cultural belief regarding whaling. Or, as Altman would have termed it, their cultural world views and environmental behaviors might have an affect on the scientific process.

Interestingly, the Journal of Cetacean Research and Management published significantly fewer dead-sample articles than not-dead articles. This could indicate that anti-whaling views or pressures have had some effect on the IWC Scientific Committee's publication decisions over time. Future studies similar to Lord or Koehler's work with group Polarization, or Kerr's work with Judgmental Sins of Commission (JofC) and Judmental Sins of Omission (JofO), might also be very useful for exploring this possible relationship of culture and scientific decision-making.

It was also generally observed, though not statistically tested, that sampling methods were more difficult to determine from the abstracts of Japanese studies. A future study might examine the detailing of sampling methods in abstracts submitted to journals published in pro-whaling versus anti-whaling countries. Also of note, since its title change in 1999, no studies employing lethal samples have been published by the JCRM. Again, another interesting study might follow the publication trends of these journals – and others – over more extensive periods of time.

Another point of interest drawn from this study's data was that some amount of dead sample research has been consistently published by UK and US authors over the last decade. This could suggest that some UK and US authors believe the types of information derived from non-

living samples are important to the current direction of cetacean research. In addition, the willingness of JCRM and other journals to publish dead sample research over the last ten years could further support the argument that such research is pertinent to science today. All of which could suggest that some scientists from anti-whaling countries agree that significant information – information worth publishing in JCRM and elsewhere – is derived from dead specimens, but is not worth the intentional killing of whales.

Areas in need of future study include the assessment of cetacean researchers' current environmental ethics, possibly using a methodology similar to Dunlap's Environmental Paradigm study. Expecting that all scientists are pro- or anti-whaling simply because of their country affiliation is certainly not a safe assumption. Another area for future study concerns Kuhn's depiction of modern science. The development and acceptance of scientific paradigms, and the concept that scientists challenging an established paradigm theory are usually socially rejected, could both be examined in the case of whale research publication. The international debate over whaling issues appears, at heart, to be a conflict over past and present wildlife management policies – perhaps stemming from some larger environmental paradigm.

In closing, much further research and statistical analyses are also needed to explore the possible correlations of author's country, journal country of publication, and research article type. Further studies should statistically compare a much larger sample of journals. A study involving more journal titles, and tracking their publication decisions over a longer time period, would help further our understanding of the possible relationships between countries, their political or cultural values, and their choices in pursuing and publishing scientific research.

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Appendix I – *International Whaling Commission Members*

Antigua and Barbuda	Guinea	Peru
Argentina	India	Republic of Korea
Australia	Ireland	Russian Federation
Austria	Italy	Saint Kitts and Nevis
Brazil	Japan	Saint Lucia
Chile	Kenya	Saint Vincent and The
Costa Rica	Mexico	Senegal
Denmark	Monaco	Solomon Islands
Dominica	Morocco	South Africa
Finland	Netherlands	Spain
France	New Zealand	Sweden
Germany	Norway	Switzerland
Grenada	Oman	UK
Grenadines	People's Republic of China	USA

Source: International Whaling Commission, List of Member Nations (2000, January 18). Cambridge, UK: International Whaling Commission. Retrieved April 24, 2001 from the World Wide Web: http://ourworld.compuserve.com/homepages/iwcoffice/iwc.htm#Members.

Appendix II – ***Comparisons of Journal Circulation Sizes by Country of Publication.***

Country of Publication	Total Number of Journals	Circ. Size 1-999	Circ. Size 1000-5000	Circ Size 1-5000
UK	26,097	2,445 9.37%	4,047 15.51%	6,492 24.88%
JP	6,546	682 10.42%	796 12.16%	1,478 22.58%
CA	10,612	1,425 13.43%	2,208 20.81%	3,633 34.24%
DK	2,840	369 12.99%	597 21.02%	966 34.01%
US	90,206	9,943 11.02%	15,261 (16.92%);	25,204 27.94%
All journals in Ulrich's	119,140	25,524 21.42%	42,950 36.05%	68,474 57.47%

Source: Ulrich's On Disc; The complete Ulrich's Periodicals Directory, including irregular serials, and annuals on compact disc (2001). New York:R.R. Bowker.